

WHAT IS CLAIMED IS:

1. A head substrate of a printing head detachably mounted on a printer main body, comprising:
 - 5 plural external connection terminals individually receiving, from the exterior, a binary logic signal corresponding to whether or not to execute a recording operation, a recording image signal and a clock signal;
 - 10 recording execution means for executing the recording operation according to the recording image signal and the clock signal entered through said external connection terminals, in case said binary logic signal is in a first state;
 - 15 data memory means for executing a memory access which is at least either of data writing and data readout; and
 - 20 memory access means for recognizing said binary logic signal as an access permission signal and executing the memory access to said data memory means at a timing corresponding to the clock signal when said logic signal is in a second state.
2. A head substrate according to claim 1, wherein said external connection terminals include:
 - 25 first common terminal wiring means for supplying said externally entered binary logic signal to said memory access means and to said recording execution means; and

second common terminal wiring means for supplying said externally entered clock signal as a recording clock signal to said recording execution means and as a memory clock signal to said memory access means.

5

Subj

3. A head substrate according to claim 2,

wherein:

10 said recording execution means is adapted for executing the recording operation based on the recording image signal serially entered into one of said external connection terminals; and

15 said common terminal wiring means is adapted for serially supplying said memory access means with the input signal to the same external connection terminal that receives the serial input of the recording image signal, as writing data.

4. A head substrate according to claim 2,

wherein:

20 said recording execution means is adapted for executing the recording operation based on the recording image signal serially entered into one of said external connection terminals; and

25 said common terminal wiring means is adapted for serial supply of read data of said memory access means to the same external connection terminal that receives the serial input of the recording image signal.

Sub A2

5. A head substrate according to claim 2,

wherein:

said recording execution means is adapted for
executing the recording operation based on the
5 recording image signal parallel entered into plurality
of said external connection terminals; and

10 said common terminal wiring means is adapted for,
parallel supplying to said memory access means an input
signal to said plural external connection terminals
that receive the parallel input of the recording image
signal, as writing data.

6. A head substrate according to claim 2,

wherein:

15 said recording execution means is adapted for
executing the recording operation based on the
recording image signal parallel entered into plurality
of said external connection terminals; and

20 said common terminal wiring means is adapted for
parallel supplying read data of said memory access
means to said plural external connection terminals,
receiving the parallel input of the recording image
signal.

25 *Sub A3* 7. A head substrate according to any of claims 2
to 6, wherein:

said recording execution means includes a shift

*Sub
A3
Conf.*

register which is reset by a reset signal externally entered into one of said external connection terminals and is adapted to temporarily hold and parallel output, at a timing corresponding to the clock signal, the recording image signal serially entered into another of said external connection terminals; and

said common terminal wiring means is adapted for supplying said memory access means with the reset signal for said shift register, as said binary logic signal constituting said access permission signal.

8. A head substrate according to any of claims 2 to 6, wherein:

said recording execution means includes a shift register which is adapted to be reset by a reset signal externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal, the recording image signal serially entered into another of said external connection terminals, and a latch circuit which is adapted to be reset by said reset signal and then to temporarily hold and output the recording image signal parallel outputted from said shift register; and

said common terminal wiring means is adapted for supplying said memory access means with the reset signal for said latch circuit, as said binary logic

signal constituting said access permission signal.

*Sub
part*

9. A head substrate according to any of claims 2 to 6, wherein:

5 said recording execution means includes a shift register which is adapted to be reset by a reset signal externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal,
10 the recording image signal serially entered into another of said external connection terminals, and a latch circuit which is adapted to be reset by said reset signal and then to temporarily hold and output the recording image signal parallel outputted from said
15 shift register; and

 said common terminal wiring means is adapted for supplying said memory access means with said reset signal as said binary logic signal constituting said access permission signal.

20

10. A head substrate according to any of claims 2 to 6, wherein:

 said recording execution means includes a shift register which is adapted to be reset by a reset signal externally entered into one of said external connection terminals and then to temporarily hold and parallel output, at a timing corresponding to the clock signal,

*Sub
obj
cont.*

the recording image signal serially entered into another of said external connection terminals, and a latch circuit which is adapted to temporarily hold and output the recording image signal parallel outputted from said shift register at a timing corresponding to a latch signal externally entered into still another of said external connection terminals; and said common terminal wiring means is adapted for supplying said memory access means with said latch signal as said binary logic signal constituting said access permission signal.

11. A head substrate according to any of claims 1 to 6, wherein said recording execution means includes plural recording elements for recording the recording image signal parallel outputted from said latch circuit, corresponding to a recording pulse signal externally entered into one of said external connection terminals.

20 12. A head substrate according to claim 11, wherein said recording element is a heat generating element.

25 13. A head substrate according to any of claims 2 to 6, wherein said common terminal wiring means is adapted to supply said memory access means with the

Sub
25
Cont

clock signal for said recording image signal, as a
memory clock signal.

14. A head substrate according to any of claims 2
5 to 6, wherein:

said data memory means is means for executing both
data writing and data readout as the memory access;

10 said memory access means is means for selectively
executing either of data writing into and data readout
from said data memory means corresponding to an
externally entered mode switching signal; and

15 said common terminal wiring means is adapted for
supplying said memory access means with the input
signal to one of said external connection terminals as
the mode switching signal.

15. A head substrate according to any of claims 2
to 6, wherein:

20 said recording execution means is adapted for
receiving a driving electric power externally entered
from one of said external connection terminals; and

said common terminal wiring means is adapted for
supplying said memory access means with the driving
electric power for said recording execution means.

25

16. A head substrate according to any of claims 2
to 6, wherein said external connection terminals, said

Sub
AS
Cont.

recording execution means, said data memory means, said memory access means and said common terminal wiring means are constituted by films formed on one base substrate.

5

17. A printing head detachably mounted on a printer main body, comprising a head substrate according to any of claims 1 to 6.

10

18. A printing head according to claim 17, wherein said recording execution means includes plural recording elements for recording.

15

19. A printing head according to claim 18,

wherein said recording element is a heat generating element.

20

20. A printing head according to claim 19, wherein the recording is executed by discharging ink by the heat generated by said heat generating element.

25

21. A printing head detachably mounted on a printer main body, comprising:
plural external connection terminals individually receiving, from the exterior, a binary logic signal corresponding to whether or not to execute a recording operation, a recording image signal and a clock signal;

recording execution means for executing the recording operation according to the recording image signal and the clock signal entered through said external connection terminals, in case said binary
5 logic signal is in a first state;

data memory means for executing a memory access which is at least either of data writing and data readout; and

memory access means for recognizing said binary
10 logical signal as an access permission signal and executing the memory access to said data memory means at a timing corresponding to the clock signal when said logical signal in a second state.

15 22. A printing head according to claim 21,
wherein said external connection terminals include:

first common terminal wiring means for supplying said externally entered binary logic signal to said
memory access means and to said recording execution
20 means; and

second common terminal wiring means for supplying said externally entered clock signal as a recording clock signal to said recording execution means and as a memory clock signal to said memory access means.

25 23. A printing apparatus comprising:
a printing head according to claim 17;

input means for individually transmitting the binary logic signal of the first state and various signals such as the recording image signal and the clock signal respectively to plurality of said external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and

access control means for transmitting the binary logic signal of the second state and the clock signal, etc. to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the memory access.

24. A printing apparatus comprising:
15 a printing head according to claim 21;
input means for individually transmitting the binary logic signal of the first state and various signals such as the recording image signal and the clock signal respectively to said plurality of external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and

access control means for transmitting the binary logic signal of the second state and the clock signal, etc. to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the memory access.

25. A printing apparatus according to claim 23,
wherein:

 said input means is adapted for serial
 transmission of the recording image signal to a
5 specified one of said external connection terminals;
 and

 said access control means is adapted for serial
 transmission of the writing data for said memory access
 means to one of said external connection terminals in
10 which the recording image signal is serially entered.

26. A printing apparatus according to claim 23,
wherein:

 said input means is adapted for parallel
15 transmission of the recording image signal to a
 specified plurality of said external connection
 terminals; and

 said access control means is adapted for parallel
 transmission of the writing data for said memory access
20 means to said plurality of external connection
 terminals in which the recording image signal is
 parallel entered.

27. A printing apparatus according to claim 23,
25 wherein said recording execution means includes a heat
 generating element for recording.

*Sub
B27*

28. A printing apparatus according to claim 27,
wherein the recording is executed by discharging ink by
the heat of said heat generating element.

5 29. A printing apparatus according to claim 24,
wherein said recording execution means includes a heat
generating element for recording.

10 *Sub
A16* 30. A printing apparatus according to claim 29,
wherein the recording is executed by discharging ink by
the heat of said heat generating element.

15 31. A head substrate of a printing head
detachably mounted on a printer main body, comprising:
plural external connection terminals for
externally entering various signals and a driving
electric power;
recording execution means for executing a
recording operation according to the various signals
20 and the driving electric power externally entered into
said external connection terminals;
data memory means for executing data writing and
data readout;
memory access means for executing the data writing
25 into said data memory means in response to the various
signals and the driving electric power externally
entered into said external connection terminals and the

data readout corresponding to the various signals; and writing inhibition means for permanently disabling the data writing into said data memory means by said memory access means.

5

32. A head substrate according to claim 31,
wherein:

10 said writing inhibition means is adapted for cutting off an electric power wiring for supplying the driving electric power for data writing from said external connection terminals to said memory access means.

10

33. A head substrate according to claim 31,
15 further comprising:

common terminal wiring means for connecting said memory access means and said recording execution means to a common external connection terminal.

20

34. A head substrate according to claim 31,
wherein:

25 said external connection terminals receive, at one thereof, from the exterior, an access permission signal for permitting the data writing;

25

 said memory access means executes data writing into said data memory means when the access permission signal is externally entered from said external

2020 RELEASE UNDER E.O. 14176

connection terminal; and
said writing inhibition means is adapted for
cutting off an electric power wiring for supplying the
driving electric power for data writing from said
5 external connection terminal to said memory access
means.

35. A head substrate according to any of claims
31 to 34, wherein:

10 said memory access means writes data of plural
kinds in succession in said data memory means; and
 said writing inhibition means individually
 disables data overwriting for the data of the plural
 kinds written in succession in said data memory means
15 by said memory access means.

36. A head substrate according to any of claims
31 to 34, wherein:

20 said plural external connection terminals
externally receive, as the various signals, a binary
logic signal corresponding to whether or not to execute
the recording, a recording image signal and a clock
signal;

25 said recording execution means is adapted for
executing a recording operation by externally receiving
the recording image signal and the clock signal when
said binary logic signal externally entered from said

external connection terminals is in a first state; and
said memory access means is adapted for executing
at least either of data writing into or data readout
from said data memory means at a timing corresponding
5 to the clock signal, when said binary logic signal
externally entered into said external connection
terminal is in a second state.

37. A head substrate according to any of claims
10 31 to 34, wherein:

said recording execution means is adapted for
executing a recording operation based on the recording
image signal serially entered into a specified one of
said external connection terminals; and

15 said memory access means is adapted for writing
data, serially entered from said specified one of said
external connection terminals, into said data memory
means, and serially outputting the data read from said
data memory means to said specified one of said
20 external connection terminals.

38. A head substrate according to any of claims
31 to 34, wherein:

25 said recording execution means is adapted for
executing a recording operation based on the recording
image signal parallel entered into specified ones of
said external connection terminals; and

1 said memory access means is adapted for writing
2 data, parallel entered from said specified plurality of
3 said external connection terminals that parallel
4 receive the recording image signal, into said data
5 memory means, and for serially outputting the data,
6 read from said data memory means, to said specified
7 plurality of said external connection terminals that
8 parallel receive the recording image signal.

10 39. A head substrate according to claim 36,
11 wherein the clock signal for executing the recording
12 operation and the clock signal supplied to said memory
13 access means are used in common.

15 40. A printing head detachably mounted in a
16 printer main body, comprising a head substrate
17 according to any of claims 31 to 34.

20 41. A printing head according to claim 40,
21 wherein said recording execution means includes a
22 recording element for recording.

25 42. A printing head according to claim 41,
26 wherein said recording element is a heat generating
27 element.

30 43. A printing head according to claim 42,

wherein the recording is executed by discharging ink by
the heat of said heat generating element.

5 44. A printing head detachably mounted in a
printer main body, comprising a head substrate
according to claim 36.

10 45. A printing head detachably mounted in a
printer main body, comprising a head substrate
according to claim 37.

15 46. A printing head detachably mounted in a
printer main body, comprising a head substrate
according to claim 38.

20 47. A printing head detachably mounted on a
printer main body, comprising:
 plural external connection terminals for
 externally entering various signals and a driving
 electric power;

 recording execution means for executing a
 recording operation according to the various signals
 and the driving electric power externally entered into
 said external connection terminals;

25 data memory means capable of data readout; and
 memory access means for reading data stored in
 said data memory means;

wherein said memory access means is rendered, by writing inhibition means, permanently incapable of data writing into said data memory means.

5 48. A printing head according to claim 47, wherein said recording execution means includes a recording element for recording.

10 49. A printing head according to claim 48, wherein said recording element is a heat generating element.

15 50. A printing head according to claim 49, wherein the recording is executed by discharging ink by the heat of said heat generating element.

51. A method for producing a printing head detachably mounted on a printer main body, comprising:

20 a step of preparing a head substrate including plural external connection terminals for externally entering various signals and a driving electric power; recording execution means for executing a recording operation according to the various signals and the driving electric power externally entered into said 25 external connection terminals; data memory means capable of executing data writing and data readout; memory access means for executing the data writing into

PRINTING APPARATUS

5 said data memory means in response to the various
signals and the driving electric power externally
entered into said external connection terminals and
executing the data readout corresponding to the various
signals; and writing inhibition means for permanently
disabling the data writing into said data memory means
by said memory access means;

10 a step of executing data writing into said data
memory means by said memory access means; and
10 a writing inhibition step of permanently
disabling, by said writing inhibition means after the
data writing, the data writing into said data memory
means by said memory access means.

15 52. A method for producing the head substrate
according to claim 51, wherein:
15 said writing inhibition means is adapted for
cutting off an electric power wiring for supplying the
driving electric power for data writing from said
20 external connection terminals to said memory access
means.

25 53. A method for producing the head substrate
according to claim 51, wherein:
25 said writing inhibition means is adapted for
cutting off a signal wiring for connecting said
external connection terminals, externally receiving an

access permission signal for permitting the data writing, and said memory access means.

54. A method for producing the head substrate according to any of claims 51 to 53, wherein:

said data writing step writes data of plural kinds in succession in said data memory means by said memory access means; and

10 said writing inhibition step individually disables data overwriting for the data of the plural kinds written in succession in said data memory means by said memory access means.

55. A method for producing a printing head detachably mounted on a printer main body, comprising:

15 a step of preparing a printing head including plural external connection terminals for externally entering various signals and a driving electric power; recording execution means for executing a recording operation according to the various signals and the driving electric power externally entered into said external connection terminals; data memory means capable of executing data writing and data readout; memory access means for executing the data writing into said data memory means in response to the various signals and the driving electric power externally entered into said external connection terminals and

executing the data readout corresponding to the various signals; and writing inhibition means for permanently disabling the data writing into said data memory means by said memory access means;

5 a step of executing data writing into said data memory means by said memory access means; and
 a writing inhibition step of permanently disabling, by said writing inhibition means after the data writing, the data writing into said data memory
10 means by said memory access means.

56. A method for producing the printing head according to claim 55, wherein:

15 said writing inhibition means is adapted for cutting off an electric power wiring for supplying the driving electric power for data writing from said external connection terminals to said memory access means.

20 57. A method for producing the head substrate according to claim 55, wherein:

 said writing inhibition means is adapted for cutting off a signal wiring for connecting said external connection terminals, externally receiving an access permission signal for permitting the data writing, and said memory access means.

58. A method for producing the printing head according to any of claims 55 to 57, wherein:
said data writing step writes data of plural kinds in succession in said data memory means by said memory access means; and
said writing inhibition step individually disables data overwriting for the data of the plural kinds written in succession in said data memory means by said memory access means.

10 59. A printing apparatus comprising:
a printing head according to claim 44;
input means for individually transmitting various signals respectively to a plurality of said external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and
memory readout means for transmitting various signals to said plural external connection terminal of said printing head, thereby causing said memory access means to execute the data readout.

20 60. A printing apparatus comprising:
a printing head according to claim 45;
input means for individually transmitting various signals respectively to a plurality of said external connection terminals of said printing head, thereby

causing said recording execution means to execute a recording operation; and

memory readout means for transmitting various signals to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the data readout.

61. A printing apparatus comprising:
a printing head according to claim 46;
10 input means for individually transmitting various signals respectively to a plurality of said external connection terminals of said printing head, thereby causing said recording execution means to execute a recording operation; and
15 memory readout means for transmitting various signals to said plural external connection terminals of said printing head, thereby causing said memory access means to execute the data readout.

20 62. A printing apparatus comprising:
a printing head according to claim 44;
wherein said recording input means is adapted for individually transmitting a binary logic signal of a second state and various signals such as a recording 25 image signal and a recording clock signal respectively to a plurality of said external connection terminals of said printing head; and

5 said memory readout means is adapted for
transmitting the binary logic signal of the second
state and the memory clock signal, etc. to the
plurality of said external connection terminals of said
printing head.

10 63. A printing apparatus comprising:
a printing head according to claim 45;
wherein said recording input means is adapted for
serially transmitting the recording image signal to a
specified one of said external connection terminals of
said printing head; and

15 15 said memory readout means is adapted for serially
receiving the data read by said memory access means,
from the specified one of said external connection
terminals that serially receives the recording image
signal.

20 64. A printing apparatus comprising:
a printing head according to claim 46;
wherein said recording input means is adapted for
parallel transmission of the recording image signal to
a specified plurality of said external connection
terminals; and
25 25 said memory readout means is adapted for parallel
reception of the data read by said memory access means,
from the specified plurality of said external

RECORDED IN U.S. PATENT OFFICE

connection terminals that receives in parallel the recording image signal.

65. A printing apparatus comprising:
5 a printing head according to claim 47; and
means for driving said printing head.

66. A printing apparatus according to claim 65,
wherein ~~said recording execution means includes a~~
10 recording element for recording.

67. A printing apparatus according to claim 66,
wherein recording element is a head generating element
and ink is discharged by the heat generated by said
15 heat generating element.